Automotive Map/Reading/Dome Light
LED Drivers Introduction
-IS32LT3175P/N
IS32LT3175-Features & Application Circuit

Features

- Support PWM control and Momentary Button Control
- Button Higher Priority than PWM
- Operating voltage 6V to 42V
- Configurable from 20mA to 150mA
- Button Input is debounced and latched
- Gamma corrected fade IN/OUT algorithm
- Pull down resistors set independent fade IN and OUT ramp time
- IS32LT3175P – Positive polarity
  - IS32LT3175N – Negative polarity
- Fault Protection:
  - LED string shorted to GND
  - Over temperature
- SOP-8-EP package
- Automotive Grade - AEC-Q100 (pending)
- Operating temperature range from -40°C ~ +125°C
**IS32LT3175- Key Benefits**

- **IS32LT3175N/P with Courtesy (BCM PWM) Support**
  - Enhanced single channel version of IS32LT3120
    - Integrated debounce and latch
  - Two methods to control LED Fade Ramp
    - PWM pulse stream from BCM
    - Momentary Contact button
  - BCM (50~300Hz) PWM Dimming PIN (Active high or Active low)
    - IS32LT3175N (negative polarity), IS32LT3175P (positive polarity)
    - Directly drives the current source bypass, gamma correction and ramp time
    - Signal level can be up to battery supply voltage rail
  - For Map/Dome Lights, Door Lights, Puddle Lamps

![PWM Courtesy Light Signal (10 - 100%)](image1)

![PWM Courtesy Light Signal (10 - 100%)](image2)
**Inputs De-bounced to filter noise**

An internal debounced circuit will condition the input signal so a single press of the mechanical switch doesn't appear like multiple presses. The ENx inputs are debounced by typically 37ms.
### IS32LT3175-Key Benefits

- **High Current Accuracy, Excellent Line & Load Regulation**

<table>
<thead>
<tr>
<th></th>
<th>Absolute current accuracy</th>
<th>Min.</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>E(_{\text{OUT}})</td>
<td>(-40^\circ\text{C} &lt; T_A &lt; 125^\circ\text{C}, I_{\text{out}}=100\text{mA})</td>
<td>-5</td>
<td>5</td>
<td>%</td>
<td></td>
</tr>
</tbody>
</table>

- **Line Rg**
  - Output current line regulation
  - \(I_{\text{OUTx}} = -50\text{mA}, 6V < V_{\text{CC}} < 18V, V_{\text{OUT}} = V_{\text{CC}} - 2V\)
  - Min. \(-0.2\), Typ. \(0.2\), Unit \(\text{mA/V}\)

- **Load Rg**
  - Output current load regulation
  - \(2.5V < V_{\text{OUTx}} < V_{\text{CC}}, 2.0V, I_{\text{OUTx}} = -50\text{mA}\)
  - Min. \(-0.2\), Typ. \(0.2\), Unit \(\text{mA/V}\)

- **Support Momentary contact button input (with Fade in/Fade out) and The PWM courtesy light signal control at the same time.**
  - which saving extra Logic Gate /MCU cost.

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**Push button function overrides courtesy light signal**

- Button has priority over PWM courtesy signal
- If push button used for turning ON LED, courtesy signal is ignored
- If courtesy signal turned ON light, push button can turn it OFF
IS32LT3175-P/N Map/Dome Light with BCM PWM & Fade in/out

IS32LT3175-State Machine & Timing Sequence

- POWER UP
- LED OFF
- LED ON
- PWM Ignored
- Master#
- PWM Sample Window
- Fade ON
- Fade OFF
- Ramp Terminated Mid-stream
- Ramp Re-started Mid-stream

BCM PWM

LED State

ON

OFF

VCC

PWM Pulse Width Modulation

LED Fully ON

Fade ON Complete

Time
IS32LT3175-Key Benefits

- Excellent constant current and Fade time accuracy across -40C to 125C temp range

**Figure 9**  Output Current vs. Temperature

**Figure 7**  Fade Time vs. Temperature
✓ Constant current with excellent Line Regulation and Load Regulation

Figure 3  Output Current vs. Supply Voltage

Figure 20  Output Current vs. Headroom Voltage
✓ **Comfortable Vision  Fade in /out  LED on/off**

63 step Gamma corrected fade in/out algorithm. Programmable FADE IN, FADE OUT Time via external resistor. \( t = R_{\text{TSET}} \times 2.5\mu s \)

Fade in and Fade out time can be different to get better vision effect!
Strong Protection system

(1) Over current protection
   205mA (typical) Output current limit

(2) Output short to Ground protection
   If $V_{\text{out}} < V_{\text{SCD}}$ (Short detect voltage), The channel current will reduce to 20% of Iset

(3) Thermal protection
   In the event that the die temperature exceeds 175°C, both output channels will go to the ‘OFF’ state.
### ISSI highly competitive solution: No other competitor offers such an integrated solution with all the features in IS32LT3175

**Embedded debounce circuit with Fade in/out 1st in industry!**

<table>
<thead>
<tr>
<th>Feature</th>
<th>IS32LT3175</th>
<th>Other competitor</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fade in/Fade out</td>
<td>Yes. Integrated Gama Fade in/fade out control.</td>
<td>Need external MCU</td>
</tr>
<tr>
<td>Independent channel control</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Current Accuracy</td>
<td>+/-5%</td>
<td>+/-10%</td>
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</table>
✓ Easy to design
   IS32LT3175 replaces many discrete components so it makes a compact design solution

✓ No switching, NO EMI
   Linear current source, No inductor, No switching noise, No EMI

✓ Low BOM Cost
   Very few external components, Small PCB size so very low system cost

EXAMPLES of BOM COST REDUCTION Attached
• Existing solution is single small low-cost PCB

• IS32LT3175 Solution
  • Lowers component count
  • Adds fade in/out dimming performance

• Lower cost with increased performance

• One PCB per LED light
  • Each PCB has button, LED and control pins
  • Need two boards for Map Light solutions
  • Easy to service, replace single failing PCB light

ISSI Provides complete LED Driver solutions for all Interior Auto Lighting. We have several design wins in US, Korea and China
IS32LT3175- Competitive analysis

ISSI Provide very competitive solution to you!

Acura Map light with fade in/out

Complicated design, Many IC and components Quite expensive

ISSI Solution – Less Components
1. Most Easy to use!
   Minimum components, saves development time and total system cost
   Fast Time to market to win!

2. Help customers upgrade their product offerings
   Market Leader Position!
Automotive Interior:
- Map light
- Dome light
- Puddle lamp in doors
- Glove box
- Vanity mirror